A CODE OF CONDUCT FOR RESPONSIBLE SPACE-FARING NATIONS

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Many of us have become somewhat dependent on cell phones. We have plenty of company. The doctor who needs to make an emergency call or to use their pager, as well as the patient in dire need of assistance, rely on satellites. Ambulances that cannot afford to take a wrong turn when every second counts also rely on satellites, if they use Global Positioning System devices. Tens of thousands of police cars in the United States now use satellites to help them get to where they need to go. We need satellites to warn us of dangerous storms that are approaching landfall. We need satellites to help with disaster relief to know the best place to for helicopters to land amidst the chaos of a disaster scene. We need satellites to help those in harm's way, whether they are wearing a military uniform or not. We need these satellites more than we appreciate—every single day. Satellites are life savers. They are also essential for national and economic security. The United States is utterly dependant on satellites, and other countries are becoming more dependent on them. Satellites serve global needs.

These indispensable satellites are also quite vulnerable. It is relatively hard to master the art of making good use of satellites, and relatively easy to damage them. Any nation that can place a marble-sized object in the path of a satellite can kill that satellite. In low Earth orbit, where many vital satellites are located, any marble, or any marble-sized piece of debris, is a lethal weapon, travelling at roughly ten times the speed of a rifle bullet. It is not simple to put a marble in the path of a satellite; this takes roughly the same skills as putting a satellite into a precise orbit.

Debris is an indiscriminate killer. Any satellite collision with a piece of debris travelling in low Earth orbit—having the energy of a one-ton safe falling from a five-story building—will result in catastrophic effects, resulting in far more debris. This helps explain why many people were so upset with China for blowing up an aging satellite in January 2007. Reputable modelling of the debris field created by this anti-satellite test suggests that it created

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approximately 40,000 pieces of debris of marble size or larger. Because this test was carried out at a high altitude in low Earth orbit, it will probably take a century for this debris to burn up in the atmosphere. In other words, a country that champions a ban on weapons in outer space produced—through a single kinetic-energy anti-satellite test—40,000 weapons in outer space.

The United States conducted a similar test in 1985 during the Reagan administration. Afterwards, many Americans learned that debris-creating tests against satellites were a bad idea. It took just one test to figure this out, and hopefully it will take only one test for China to figure this out. The test that the United States conducted was at a lower altitude than the Chinese test, so the debris field took less than a quarter-century to exit low Earth orbit. One piece of debris from this anti-satellite test came within one mile of the newly launched International Space Station.

Some pieces of debris are so small that they cannot be tracked—even by the United States, which has the world's best space situational awareness capabilities. Usually, these minute objects are not lethal. The US Space Shuttle's windows have needed to be changed 55 times because of small debris hits that caused pockmarks, but thankfully did not crack them, which could have had catastrophic consequences. China's manned spaceflight programme is now endangered by debris of its own making—debris that China cannot track. There are approximately 300 satellites between the debris field created by China's anti-satellite test and the Earth's atmosphere. Three hundred satellites—a huge international investment—have been placed at risk as a result of a single test. Outer space is endlessly vast, so it is possible that no satellites will be struck by man-made debris (although the United States has already found it necessary to move one of its satellites to avoid a potential debris hit from the Chinese test). But why double the odds of a collision, as the Chinese have done with their January 2007 anti-satellite test?

There are other ways to destroy satellites. One way—also quite indiscriminate—is to use a medium-range missile carrying a nuclear weapon. A nuclear detonation in the atmosphere can do great damage to satellites, irrespective of ownership. The United States learned this in 1962 before the Limited Nuclear Test Ban Treaty, which banned atmospheric tests, was signed. The United States conducted a series of tests—the biggest having a yield in excess of one megaton—that created a radiation belt that

destroyed or damaged every satellite in low Earth orbit; not all of them were US satellites.

A number of nations could use nuclear weapons and "hit-to-kill" anti-satellite weapons to create a mess in outer space. These technologies are decades old. There are also more discriminate ways to attack, destroy or temporarily disable satellites. Lasers and jammers can perform this mission. The Bush administration and the Pentagon would prefer, if push comes to shove and space weapons are used for the first time in the history of warfare, to use weapons that produce temporary and reversible effects. China is working hard on lasers. Russia certainly knows how to use lasers. Many countries can use jammers to try to interfere with satellites. Of course, if one country uses temporary and reversible effects against another country's satellites in a deep crisis or in a war, the country that has been attacked in outer space may be able to respond in kind. Or the country that has been attacked may decide to fight by different rules, in outer space or on the ground.

Space-faring nations are therefore faced with a dilemma: satellites are indispensable, but they are also extremely vulnerable. The satellites of major powers are also intimately connected with nuclear deterrence because nuclear forces depend on satellites for intelligence and targeting information, weather forecasting data, early warning and communications. An attack against these satellites in any conflict or deep crisis between major powers could result in unintended escalation across the nuclear threshold. If a shooting war in outer space is initiated, it could be very difficult to control the shooting and to dictate tactics. It is hard enough for powerful countries to dictate tactics in ground warfare against far weaker opponents. Would it be any easier to dictate tactics in a space war between major powers? The achievement of "space dominance" is very difficult, while asymmetric warfare in outer space can be relatively simple.

What is the best way to deal with the dilemma that satellites are both indispensable and extremely vulnerable? My analysis suggests that the use of weapons against space objects is not a very satisfactory way to resolve this dilemma. If warfare directed against space objects is the wrong answer, is a treaty banning space weapons the right answer?

China, Russia and many other countries support a treaty banning space weapons. So too do many non-governmental organizations. I have my doubts that such a treaty can be successfully negotiated.

First and foremost, a treaty banning space weapons requires an agreed definition of space weapons. What is it that we seek to ban? Many things can be used as space weapons. As noted above, marbles could be tested, deployed and used as space weapons. Do we ban marbles? Jamming devices can be used as space weapons. Many countries have jammers. Do we ban jammers? Lasers can be used as space weapons. But lasers can also be used as space tracking, range finding, intelligence collection or communication devices. Do we ban lasers?

Medium-range ballistic missiles can be used as space weapons. Intercontinental missiles, based on land or at sea, can be used as space weapons. Certain missile defence interceptors, including those deployed around Moscow and in Alaska and California, can be used as space weapons. Do we ban missile defences in order to ban space warfare?

Many different types of weapons and technical capabilities can be used to interfere with or destroy satellites. Because there is so much residual or latent capability to do so, and because these capabilities are essential for other military missions, they cannot all be banned. An all-encompassing definition of space weapons is militarily, politically and diplomatically unfeasible.

An alternative approach would define space weapons far more narrowly—as devices that are specifically designed and tested to interfere with, or to harm in any way, space objects. By focusing only on "dedicated" space weapons, it is possible to avoid the trap of over-reaching. But this narrow approach does nothing to address the wide range of capabilities that could still do harm to satellites.

It is, therefore, very hard to define that which a space treaty seeks to ban. One definition of space weapons is far too encompassing, the other is far too narrow. The Carter administration encountered this problem in anti-satellite warfare negotiations with the Soviet Union. Back then, the Soviet Union sought an encompassing definition of space weapons, which included the Space Shuttle, because it had an arm that could capture a satellite, put it in the cargo bay and take it back to Earth. Using the Space Shuttle as an anti-satellite weapon would be extremely hazardous and unlikely, but by the definition advanced by the Soviet Union in the 1970s—and by the definition of a space weapon now advanced by Beijing and Moscow—the

Space Shuttle would be an anti-satellite weapon. It will take a very, very long time to negotiate a treaty banning space weapons.

Because negotiating a treaty banning space weapons would be so hard, does that mean that we are doomed to lose indispensable satellites in warfare? No. We are now in the fifth decade of the space age. In the past half-century, no weapons have been used against space objects in a deep crisis or in warfare. Not one. There have been a modest number of tests of anti-satellite weapons, and for short periods of time, "dedicated" anti-satellite weapons were deployed by the United States and the Soviet Union. But tests of anti-satellite weapons are a rare occurrence, and major powers have not been eager to deploy or use them.

There were many reasons for this uncommon restraint during the Cold War, when the superpowers tested thousands of nuclear weapons, deployed hundreds of new ballistic missiles every year, and maintained their nuclear forces on hair-trigger alert. One reason for restraint was the connection between nuclear forces and the satellites they relied upon. Moscow and Washington knew that to attack satellites would risk unwanted escalation. Indeed, both superpowers negotiated "non-interference" clauses protecting satellites used to monitor each other's nuclear forces in bilateral nuclear arms control and arms reduction agreements. A second reason for restraint was that the superpowers believed that they would both lose in the event of warfare against space objects. A third reason was that, with so much latent anti-satellite capability, neither country felt it particularly necessary to repeatedly test or deploy weapons dedicated to this role.

All of these reasons still apply in crises or limited wars between major powers. Every nation that depends on satellites will lose if those satellites are used for target practice, since vulnerabilities to attack and disruption will continue to exceed protective measures. If major powers repeatedly test and deploy dedicated anti-satellite weapons, their security will diminish and the global economy will be placed at risk. A form of deterrence between major powers continues to exist in outer space, just as during the Cold War. Deterrence against space warfare has held for half a century. This form of deterrence has been relatively inexpensive: unlike nuclear deterrence, it does not require repeated testing, expensive deployments and hair-trigger alerts. The nation that seeks to upend this deterrence will do lasting damage to itself as well as to others. Because of the enduring indispensability and vulnerability of satellites, the future testing and deployment of dedicated space weapons is

not inevitable. If it were inevitable, it would have occurred during the Cold War. The reasons why it did not occur then remain valid today. If national leaders are wise, they will not translate military plans into flight tests and deployments of weapons designed to harm space objects.

How, then, do we ensure that invaluable but extremely vulnerable satellites remain available for use when needed? If the use of weapons against space objects and a treaty banning space weapons are not good answers, then what is? How can we continue a five-decade-long record of uncommon restraint that allows nations to fulfil the vision of the Outer Space Treaty?

The Henry L. Stimson Center has been working with non-governmental partners in Canada, China, France, Japan and Russia to develop a Code of Conduct for Responsible Space-Faring Nations. Many codes of conduct already exist. Imagine the chaos that would result if there were different rules for air travel across regions or borders. We rely on codes on conduct for vehicular traffic, ships and planes. The US military and others abide by codes of conduct. Moscow and Washington have signed codes of conduct governing military interactions at sea, on the ground and in the air. The Incidents at Sea Agreement (1972) and the Dangerous Military Practices Agreement (1989) are model codes of conduct that include provisions that could also be applicable for outer space.

The outline of a Code of Conduct for Responsible Space-Faring Nations is beginning to come into view. One key element of such a code is debris mitigation similar to the guidelines agreed upon in the Committee on the Peaceful Uses of Outer Space in 2007. There is, however, no holistic approach to a Code of Conduct that is being undertaken by governmental authorities. This is why the Stimson Center and its non-governmental partners have focused on this initiative.

A Code of Conduct is needed because “rules of the road” for outer space are no less important than rules of the road on the ground, at sea or in the air. Rules of the road make driving safer; without rules, there would be chaos, and chaos in outer space is not in the interest of military, business and scientific establishments. Rules become norms, and norms can become treaties. While rules during peacetime and rules during warfare can be quite different, even warfare has rules. If the analysis presented here is sound, then protections for satellites should also be respected even in the event of warfare. Rule breakers can still be expected, but their presence does not

negate the need for rules. Indeed, without rules, there are no rule breakers; having rules helps to isolate and penalize such actors.

A Code of Conduct is needed for outer space because, while some rules already exist, there are many loopholes. The use of outer space is expanding, and the potential for friction is growing. The absence of a Code of Conduct and growing concerns over military doctrines for space warfare encourage hedging strategies. These strategies are reflected in the flight testing of multipurpose technologies by China and the United States—technologies that could be used for peaceful as well as offensive purposes in outer space—as well as in the Chinese "hit-to-kill" anti-satellite test in January 2007. Hedging strategies are reinforced by the absence of regular discussions or negotiations on space security. This equation means more hedging, less security and a growing interest in devices that can interfere with or otherwise harm space objects.

A Code of Conduct would serve to increase space security and promote the peaceful uses of outer space—the same general purposes served by a treaty to ban space weapons. Treaty negotiation—especially one carried out in the Conference on Disarmament, which operates by consensus, and which has been tied to a very challenging negotiation for a fissile material cut-off treaty—would take a very long time to complete and could result in a lowest-common-denominator outcome. Even then, the treaty might take many years to enter into force. A Code of Conduct could be produced much sooner, and could be pursued in many different forums. A small group of stakeholders could work together to produce a higher-common-denominator result, which might then be considered by a wider group of countries.

The outlook for a treaty banning space weapons is poor. The outlook for a Code of Conduct is much brighter. The European Union has, in principle, endorsed this idea. The governments of Canada and Switzerland have as well. The chief executive officer of Intelsat, the largest multinational satellite service provider, has endorsed this idea. Two key publications of the trade press in the United States, *Aviation Week and Space Technology* and *Space News*, have also endorsed a Code of Conduct.

What key elements might be included in a Code of Conduct for Responsible Space-Faring Nations? The proposed Code of Conduct devised by the Stimson Center and our partners is built around the key element of "no

harmful interference" with space objects. This formulation, which is borrowed from other agreements, avoids the traps associated with trying to define what constitutes a space weapon. The "no harmful interference" injunction applies to dedicated anti-satellite weapons, latent or residual anti-satellite capabilities, and multipurpose technologies used in a harmful manner. Participating states would still require common understandings of what constitutes "harm", but this is a far simpler problem than trying to define space weapons. Our proposed Code of Conduct also includes key elements of providing advance notice if there is reason to believe that activities in space may inadvertently cause harmful interference, and consultations when concerned about harmful interference.

What other key elements might be included? The proposed Code of Conduct also includes provisions to share space surveillance data; to adopt and abide by debris mitigation guidelines for space launches and other activities in space; to refrain from the deliberate creation of persistent space debris; to devise, implement and abide by a traffic management system for outer space; and to provide accurate and timely launch notification and registration.

This notional Code of Conduct could certainly be improved upon, and the Stimson Center welcomes such efforts. Careful readers will note that which is not included in this short list of proposed key elements: there is no prohibition against space-based missile defences. This conscious decision reflects several considerations. First, defensive responses to ballistic missile attacks are very different from offensive attacks against satellites. Second, tests of ballistic missile defences have in the past, and can continue to be carried out, in ways that do not create persistent space debris. Third, attempts to prevent space-based missile defences by means of a Code of Conduct are likely to prevent its acceptance in the United States. And fourth, the conclusion and proper implementation of a Code of Conduct is likely to reduce the perceived need to test and deploy space-based missile defences, which have, in any event, encountered sustained political, technical and budgetary roadblocks.

A Code of Conduct for Responsible Space-Faring Nations cannot solve every problem, but it can make many problems less worrisome. A Code of Conduct is no substitute for national means of defence, but it can make the use of force in space less likely. A Code of Conduct does not take away latent or residual means to carry out attacks against space objects. Instead,

these means would backstop proper implementation of the Code. Codes of conduct to prevent dangerous activities have proven their worth in many domains, including military activities on the ground, at sea and in the air. A Code of Conduct for Responsible Space-Faring Nations could also make significant contributions to international security.